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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/790,953	03/02/2004	Larry D. Seiler	00100.02.0004	2164

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ADVANCED MICRO DEVICES, INC.
C/O VEDDER PRICE KAUFMAN & KAMMHOLZ, P.C.
222 N.LASALLE STREET
CHICAGO, IL 60601

EXAMINER	
PAPPAS, PETER	
ART UNIT	**PAPER NUMBER**
2628	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	12/28/2006	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/790,953	SEILER ET AL.	
	Examiner	Art Unit	
	Peter-Anthony Pappas	2628	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *04 October 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-15 and 17-29* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-15 and 17-29* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *04 October 2006* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 101

1. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

2. Claims 1-15 and 26-29 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter. While abstract ideas, natural phenomena and laws of nature are not eligible for patenting, methods and products employing abstract ideas, natural phenomena, and laws of nature to perform a real-world function may well be. For claims including such excluded subject matter to be eligible, the claim must be for a practical application of the abstract idea, law of nature, or natural phenomenon. Diehr, 450 U.S. at 187, 209 USPQ at 8 ("application of a law of nature or mathematical formula to a known structure or process may well be deserving of patent protection."); Benson, 409 U.S. at 71, 175 USPQ at 676 (rejecting formula claim because it "has no substantial practical application"). To satisfy section 101 requirements, the claim must be for a practical application of the § 101 judicial exception, which can be identified in various ways: the claimed invention "transforms" an article or physical object to a different state or thing; the claimed invention otherwise produces a useful, concrete and tangible result.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1-15 and 17-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Aila et al. (U.S. Pub. No. US 2005/0134588 A1) in view of Greene et al. (U.S. Patent No. 5, 579, 455).

5. In regard to claim 1 Aila et al. teaches a method and apparatus for image processing (Abstract; p. 2, ¶ 18). When images are processed, the frame buffer (including the color buffer and the z buffer) containing pixels of an image is typically divided into sets of pixels often called tiles. The tiles are often non-overlapping rectangular areas. For example, an image can be divided into non-overlapping 8x8 pixel regions (p. 3-4, ¶ 52).

To accelerate rendering of an image, the following extra information is often stored for each tile: the minimum of all depth values in the tile, Zmin, and the maximum of all depth values in the tile, Zmax. It is appreciated that for processing shadow information more efficiently, a new concept may be introduced. The perimeter of the tile and the minimum and maximum depth values define a tile volume. For a rectangular tile, for example, the tile volume is a 3D axis-aligned box in screen space, defined by the horizontal and vertical bounds of the rectangular tile together with the Zmin and Zmax values (p. 4, ¶ 53). It is appreciated that the tile volume need not necessarily be defined using the minimum and maximum depth values relating to a tile. A tile volume can be determined using the depth values relating to a tile in a different way. An alternative is, for example, the use of two planes: one plane in front of all depth values

relating to a tile, and the other plane behind the depth values, for instance. The planes can be determined based on the depth values relating to the tile. The Zmin and Zmax values are, however, a very convenient way to define the tile volume, as this information is typically available (p. 4, ¶ 53).

To further enhance the performance of the graphics processor, it is possible to use a hierarchical stencil buffer or other hierarchical information store for shadow information (stencil code). If the result (stencil value) of the stencil test can be determined from a tile-specific entry of the hierarchical stencil buffer (containing a shadow mask), the per-pixel stencil buffer entries need not be accessed (p. 6, ¶ 83; p. 7, ¶ 88; Fig. 4). It is implicitly taught that said entries can be accessed and thus it is noted that accessing said stencil buffer entries is considered to read on updating.

Aila et al. fails to explicitly teach a hierarchical Z value range. Greene et al. teaches a hierarchical Z-buffer scan-conversion algorithm that does well on both (a) quickly rejecting most of the hidden geometry in a mode, and (b) exploiting the spatial and temporal coherence of the images being generated. The method uses two hierarchical data structures, an object-space octree and an image-space Z-pyramid, in order to accelerate scan conversion. The two hierarchical data structures make it possible to reject hidden geometry (hierarchical Z value test fails) very rapidly while rendering visible geometry (hierarchical Z value test passes) with the speed of scan conversion (Abstract). Greene et al. further teaches that for each such Z-max element, the depth value which is written into that element is the farthest depth value in any of the Z-max elements which are covered by such Z-max element in the next finer

granularity level. If the depth buffer 502 also includes Z-min elements, then the inner iteration also visits each of the Z-min elements in the current level. For each such Z-min element, the depth value which is written into that element is the nearest depth value in any of the Z-min elements which are covered by such Z-min element in the next finer granularity level (column 14, lines 48-62). It is noted that a respective Z-min and Z-max value for a given element, e.g. Fig. 5A element 512, (tile) is considered to represent a depth range.

It would have been obvious to one skilled in the art, at the time of the applicant's invention, to incorporate the teachings of Greene et al. into the method taught by Aila et al., because through such incorporation the rejection of hidden geometry, through the use of depth information, would be improved in terms of speed, thus allowing for more information to be processed in a shorter amount of time.

6. In regard to claim 2: stencil test fails see Aila et al. – p. 7, ¶ 86; stencil test passes see Aila et al. – p. 7, ¶ 89; and hierarchical Z value test passes see Greene et al. – Abstract).

7. In regard to claim 3 the rationale disclosed in the rejection of claim 2 is incorporated herein.

8. In regard to claim 4: stencil test fails see Aila et al. – p. 7, ¶ 86.

9. In regard to claim 5 see Greene et al. – column 11, lines 4-12; column 15, lines 48-67; column 16, lines 1-6; column 17, lines 24-40.

10. In regard to claim 6 see Aila et al. – p. 9, ¶ 102, 106.

11. In regard to claim 7 the rationale disclosed in the rejection of claim 1 is incorporated herein. It is noted each of said depth elements 512 are considered to represent respective pixel elements 204 (Fig. 2, 5A) and therefor results, at least in part, in per-pixel processing.

12. In regard to claim 8 the rationale disclosed in the rejection of claim 1 is incorporated herein.

13. In regard to claim 9 Aila et al. teaches that if the Boolean boundary value (indicator) in the temporary tile classification buffer is TRUE for a tile, this needs to be rasterized using a finer resolution, for example, using per-pixel resolution. Otherwise the rasterization can be skipped, because the entire tile is either in shadow or lit (p. 7, ¶ 86).

14. In regard to claim 10 the rationale disclosed in the rejection of claim 7 is incorporated herein.

15. In regard to claim 11 the rationale disclosed in the rejection of claim 8 is incorporated herein (Aila et al. – p. 6, ¶ 83; p. 7, ¶ 88; Fig. 8).

16. In regard to claim 12 the rationale disclosed in the rejection of claim 6 is incorporated herein.

17. In regard to claim 13 Greene et al. further teaches that if the Z-pyramid value is closer, we know the primitive is hidden in the quadrant. If we fail to prove that the primitive is hidden in one of the quadrants, we go to the next finer level of the pyramid for that quadrant and try again. Ultimately, we either prove that the entire polygon is hidden, or we recurse down to the finest level of the pyramid and find a pixel covered by

the polygon that has a Z-value farther away than the nearest Z value in the polygon (column 6, lines 28-36). The rationale and motivation disclosed in the rejection of claim 5 is incorporated herein.

18. In regard to claim 14 the rationale disclosed in the rejection of claim 8 is incorporated herein. It is noted that when respective pixels of a tile are considered lit, respective to a mask, and a hierarchical Z value test passes that a positive indication is considered to be set.

19. In regard to claim 15 the rationale disclosed in the rejection of claims 3 and 4 are incorporated herein.

20. In regard to claim 17 the rationale disclosed in the rejection of claims 1 and 5 is incorporated herein. It is noted a comparator (Aila et al. – Fig. 5, element 501) is considered coupled to a hierarchical Z buffer (Aila et al. – Fig. 5, element 521; Greene et al., Fig. 1, element 104), stencil cache (Aila et al. – Fig. 5, element 523) and hierarchical Z buffer and stencil cache updater (Aila et al. – Fig. 5m, element 510).

21. In regard to claim 18 the rationale disclosed in the rejection of claim 17 is incorporated herein.

22. In regard to claim 19 the rationale disclosed in the rejection of claim 17 is incorporated herein.

23. In regard to claim 20 the rationale disclosed in the rejection of claim 14 is incorporated herein.

24. In regard to claim 21 the rationale disclosed in the rejection of claim 4 is incorporated herein. Aila et al. teaches a tile processing and classifying module 513 (kill) module which is coupled to said hierarchical Z buffer and stencil cache updater.

25. In regard to claim 22 it is noted that data stored in said buffers is either ignored or retrieved (updated) based on said indicator.

26. In regard to claim 23 the rationale disclosed in the rejection of claim 17 is incorporated herein.

27. In regard to claim 24 the rationale disclosed in the rejection of claim 17 is incorporated herein.

28. In regard to claim 25 the rationale disclosed in the rejection of claim 22 is incorporated herein.

29. In regard to claim 27 the rationale disclosed in the rejection of claims 11 and 13 is incorporated herein.

30. In regard to claim 28 the rationale disclosed in the rejection of claim 14 is incorporated herein.

31. In regard to claim 29 the rationale disclosed in the rejection of claim 1 is incorporated herein.

Response to Arguments

32. In response Applicant's remarks that Greene et al. teaches that the Z-max value and the Z-min value of the Z-pyramid are always compared to the same z-value of the primitive it is noted that Greene et al. teaches that for each such Z-max element, the depth value which is written into that element is the farthest depth value in any of the Z-

max elements which are covered by such Z-max element in the next finer granularity level. If the depth buffer 502 also includes Z-min elements, then the inner iteration also visits each of the Z-min elements in the current level. For each such Z-min element, the depth value which is written into that element is the nearest depth value in any of the Z-min elements which are covered by such Z-min element in the next finer granularity level (column 14, lines 48-62). It is further noted that said farthest and nearest depth values are considered different z-values (i.e. different range) of a given primitive.

33. In response Applicant's remarks that Greene et al. teaches comparing each of the Z-min value and Z-max value with a single representative z-value of a given primitive it is noted that Greene et al. teaches that for each such Z-max element, the depth value which is written into that element is the farthest depth value in any of the Z-max elements which are covered by such Z-max element in the next finer granularity level. If the depth buffer 502 also includes Z-min elements, then the inner iteration also visits each of the Z-min elements in the current level. For each such Z-min element, the depth value which is written into that element is the nearest depth value in any of the Z-min elements which are covered by such Z-min element in the next finer granularity level (column 14, lines 48-62). It is further noted that said farthest and nearest depth values are considered different z-values (i.e. different range) of a given primitive.

34. In response to Applicant's remarks that neither Greene et al. or Aila et al. teach updating the hierarchical Z value range and the stencil code in response thereto:

Greene et al. teaches comparing each of the Z-min value and Z-max value with a single representative z-value of a given primitive it is noted that Greene et al. teaches

that for each such Z-max element, the depth value which is written into that element is the farthest depth value in any of the Z-max elements which are covered by such Z-max element in the next finer granularity level. If the depth buffer 502 also includes Z-min elements, then the inner iteration also visits each of the Z-min elements in the current level. For each such Z-min element, the depth value which is written into that element is the nearest depth value in any of the Z-min elements which are covered by such Z-min element in the next finer granularity level (column 14, lines 48-62).

Aila et al. teaches that to further enhance the performance of the graphics processor, it is possible to use a hierarchical stencil buffer or other hierarchical information store for shadow information (stencil code). If the result (stencil value) of the stencil test can be determined from a tile-specific entry of the hierarchical stencil buffer (containing a shadow mask), the per-pixel stencil buffer entries need not be accessed (p. 6, ¶ 83; p. 7, ¶ 88; Fig. 4). It is implicitly taught that said entries can be accessed and thus it is noted that accessing said stencil buffer entries is considered to read on updating.

35. In response to Applicant's remarks that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988)and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992).

Furthermore, in response to Applicant's remarks that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971).

In the case of Aila et al. in view of Greene et al. it would have been obvious to one skilled in the art, at the time of the applicant's invention, to incorporate the teachings of Greene et al. into the method taught by Aila et al., because through such incorporation the rejection of hidden geometry, through the use of depth information, would be improved in terms of speed, thus allowing for more information to be processed in a shorter amount of time.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Peter-Anthony Pappas whose telephone number is 571-272-7646. The examiner can normally be reached on M-F 9:00am-5:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ulka Chauhan can be reached on 571-272-7782. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Peter-Anthony Pappas
Examiner
Art Unit 2628

PP

WESNER SAJOUS
Primary Examiner